Ion Propulsion System and Orbit Maneuver Integration in CubeSats

Completed Technology Project (2013 - 2016)

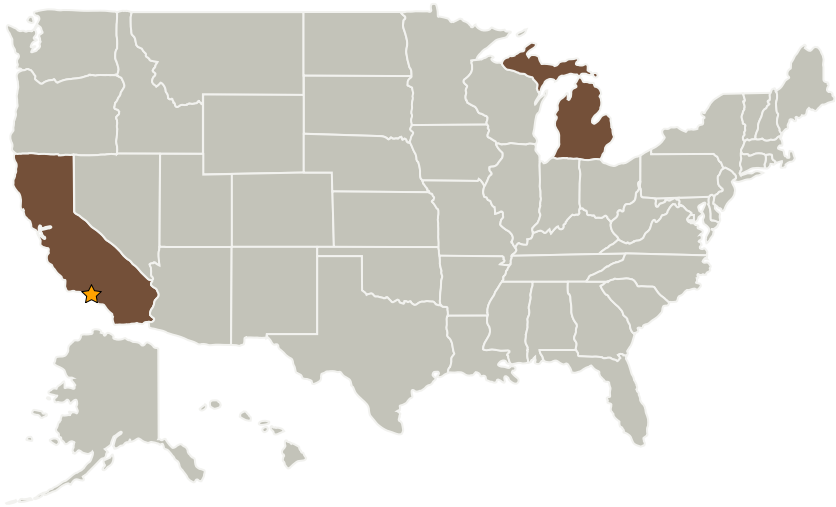
Project Introduction

An integrated CubeSat propulsion and control system is proposed that provide three-axis attitude control and orbit maneuver capability using a micro radio-frequency ion thruster. A control algorithm will be developed for robust attitude control (for pointing solar arrays etc.), plus trajectory optimization for maximum orbit change. Propulsion system integration issues, such as interacting magnetic fields between the propulsion and attitude control systems, will be investigated and addressed in the control algorithm. The possibility of thrust vectoring will be researched. The results will quantify the maneuver capabilities that can be expected of future small spacecraft using electric propulsion systems.

Anticipated Benefits

This project will make significant progress toward implementation of electric propulsion on small satellites. The results of this research will quantify the maneuver capabilities that can be realistically expected of future small satellites using small electric propulsion systems.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Western Michigan University	Supporting Organization	Academia	Kalamazoo, Michigan

Primary U.S. Work Locations	
California	Michigan

Project Transitions

October 2013: Project Start

April 2016: Closed out

Closeout Summary: Publications: https://ntrs.nasa.gov/search.jsp?R=20150016067 https://ntrs.nasa.gov/search.jsp?R=20160008249 Jennifer Hudson, Sara Spangelo, Andrew Hine, Daniel Kolosa, and Kristina Lemmer. "Mission Analysis for CubeSats with Micropropulsion", Journal of Spacecraft and Rockets, Vol. 53, No. 5 (2016), pp. 836-846. https://doi.org/10.2514/1.A33564

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Center / Facility:
Jet Propulsion Laboratory (JPL)

Responsible Program:
Small Spacecraft Technology

Project Management

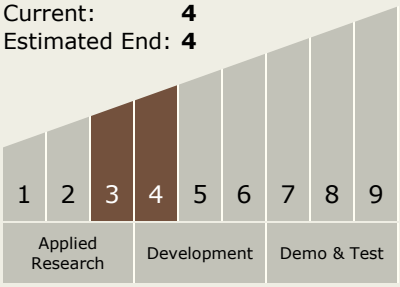
Program Director:
Christopher E Baker

Program Manager:
Roger Hunter

Principal Investigator:
Jennifer Hudson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic

Target Destination

The Moon